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Presentation title: E-band and D-band VCOs: Distributed Tank Design Methodology, Bufferless Approach

SHORT ABSTRACT OF PRESENTATION

Wireless communications have already moved into the millimeter wave (mmWave) range to satisfy the needs of an increasingly data-hungry society. To assure these speeds for the end-user, the backhaul, which carries the bulk of the data to be transmitted, needs to operate at even higher frequencies: to give the example of 5G, this happens at the E-band (71–76 GHz and 81–86 GHz).

Integrated circuit design at mmWaves relies heavily on the technology employed, both for active and passive devices. Nowadays, RF-oriented CMOS or BiCMOS technologies offer solutions to enable integrated circuit design at mmWaves, such as high-performance transistors and backends with thick upper metal layers for low loss passive devices. mmWave circuits are greatly impacted by interconnection parasitics, which oftentimes demands innovative solutions to enable a design or mitigate performance degradations. In the case of mmWave Voltage Controlled Oscillator (VCO) design accumulation, MOS varactors are the bottleneck of the tank performance, since their Q-factor is much lower than that of inductive resonators. However, varactor is the only passive device that is continuously variable and remains essential in VCO design. Moreover, MOS varactor losses are directly related to the channel area; so larger varactors, necessary for wide frequency tuning ranges (FTR), are more lossy than smaller varactors, thus evidencing an intrinsic design compromise between wide FTR and resonator quality factor.

A way to improve the tank performance consists in using distributed resonators

based on slow-wave coplanar strip (S-CPS). Localized and periodically loaded with varactors topologies can be used. In order to accelerate the design, the electrical model and design methodology for such a resonator have to be developed, as well as how to size a MOSFET cross-coupled pair to realize loss compensation using a global optimization procedure on the loaded S-CPS resonator.

KEYWORDS

CMOS, distributed resonator, mmWaves, slow-wave coplanar stripline, standing-wave oscillator, SWO, VCO

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BIOGRAPHY

Leonardo received the bachelor's degree in electrical engineering from the University of São Paulo, Brazil, in 2015, the M.Sc. degree in microelectronics also from the University of São Paulo, Brazil, in 2017, where he worked on designing of interposer antennas and passive devices at 60 GHz. In 2018, he enrolled into his Ph.D. in Cotutelle between the University of São Paulo and Université Grenoble-Alpes, France, where he worked on E-band, standing-wave oscillators, having also worked afterwards on frequency multipliers for D-band frequency generation and slow-wave interconnections for mmWaves on BiCMOS. He is currently working as an analog/RF design engineer at ST Microelectronics Crolles, France.